

**U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAME: *Cyrtandra oxybapha*

COMMON NAME: Ha'iwale

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: August 2005

STATUS/ACTION:

☐ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

☐ New candidate

☒ Continuing candidate

☐ Non-petitioned

☒ Petitioned - Date petition received: May 11, 2004

☐ 90-day positive - FR date:

☒ 12-month warranted but precluded - FR date: May 11, 2005

☐ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions. During the past 12 months, most of our national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing determinations, emergency listing evaluations and determinations and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (<http://endangered.fws.gov>).

☐ Listing priority change

Former LP: ☐

New LP: ☐

Date when the species first became a Candidate (as currently defined): 1997

☐ Candidate removal: Former LP: ☐

☐ A – Taxon is more abundant or widespread than previously believed or not subject to

the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

- ___ U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
- ___ F – Range is no longer a U.S. territory.
- ___ I – Insufficient information exists on biological vulnerability and threats to support listing.
- ___ M – Taxon mistakenly included in past notice of review.
- ___ N – Taxon does not meet the Act’s definition of “species.”
- ___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Gesneriaceae (African violet family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Maui

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Maui

LAND OWNERSHIP:

Cyrtandra oxybapha occurs on private land.

LEAD REGION CONTACT: Paul Phifer, 503-872-2823, paul_phifer@fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, 808-792-9400, christa_russell@fws.gov

BIOLOGICAL INFORMATION:

Species Description *Cyrtandra oxybapha* is a shrub 2 to 3 meters (m) (7 to 10 feet (ft)) tall, with many-branched stems. Leaves are opposite on the upper three to four nodes, unequal and slightly asymmetrical, papery, and circular to broadly elliptic, 12 to 18 centimeters (cm) (5 to 7 inches (in)) long, and 8 to 9 cm (5 to 7 in) wide. The upper surface of the leaf is moderately hirtellous, the lower surface is densely velvety villous. Flowers are one to two in cymes arising from the leaf axils and densely villous throughout. The calyx is nearly actinomorphic, pale green, papery, bell-shaped, and 21 millimeters (mm) (0.8 in) long, and the corolla is white with a flaring cylindrical tube 19 to 20 mm (0.75 to 0.79 in) long and 10 to 11 mm (0.39 to 0.43 in) in diameter. Berries are white, ovoid, 1.8 cm (0.7 in) long, and have a persistent spreading calyx. This species is distinguished from *C. platyphylla* by its bell-shaped calyx, fewer-flowered cymes, and larger corolla tubes (Wagner *et al.* 1999a).

Taxonomy *Cyrtandra oxybapha* was described by W.L. Wagner and D. Herbst. This species is recognized as a distinct taxon in Wagner *et al.* (1999a) and Wagner and Herbst (2003), the most recently accepted Hawaiian plant taxonomy.

Habitat *Cyrtandra oxybapha* is found in open understory in *Metrosideros polymorpha*-*Cheirodendron trigynum* montane wet forest to mesic *Acacia-Metrosideros* forest with *Broussaisia arguta*, *Coprosma* sp., *Cyanea macrostegia*, *Cyrtandra grayana*, *C. hawaiiensis*, *Hedyotis terminalis*, *Labordia* sp., *Vaccinium* sp., and ferns, at elevations between 1,183 and 1,536 m (3,880 and 5,040 ft) (Hawaii Natural Heritage Program Database 2004).

Historical and Current Range/Current Status Historically rare, *Cyrtandra oxybapha* was typically found in wet forest on the island of Maui. Currently, this species is known only from one population totaling 250 to 300 individuals in the Kahikinui area of east Maui and one additional population of 25 individuals on west Maui (Robert Hobdy, Hawaii Division of Forestry and Wildlife, pers. comm. 1996; Arthur C. Medeiros III, U.S.G.S. Biological Resources Discipline, pers. comm. 1996; Steve Perlman, National Tropical Botanical Garden, pers. comm. 1996; Hank Oppenheimer, Maui Land and Pineapple Company, pers. comm. 2004).

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range.
This species is highly and imminently threatened by feral pigs (*Sus scrofa*) that adversely modify habitat (R. Hobdy, pers. comm. 1996; A. Medeiros III, pers. comm. 1996; S. Perlman, pers. comm. 1996). As early as 1778, European explorers introduced livestock, which became feral, increased in number and range, and caused significant changes to the natural environment of Hawaii. Past and present activities of introduced alien mammals are the primary factor altering and degrading vegetation and habitats on Maui. The pig is originally native to Europe, northern Africa, Asia Minor, and Asia. European pigs, introduced to Hawaii by Captain James Cook in 1778, became feral and invaded forested areas, especially wet and mesic forests and dry areas at high elevations. They are currently present on Maui and four other islands, and inhabit rain forests and grasslands. While rooting in the ground in search of the invertebrates and plant material they eat, feral pigs disturb and destroy vegetative cover, trample plants and seedlings, and threaten forest regeneration by damaging seeds and seedlings. They disturb soil and cause erosion, especially on slopes. Alien plant seeds are dispersed on their hooves and coats as well as through their digestive tracts, and the disturbed soil is fertilized by their feces, helping these plants to establish. Pigs are a major vector in the spread of many introduced plant species (Smith 1985; Stone 1985; Medeiros *et al.* 1986; Scott *et al.* 1986; Tomich 1986; Cuddihy and Stone 1990; Wagner *et al.* 1999a). Pig exclusion fences protect the smaller of the two known populations of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

B. Overutilization for commercial, recreational, scientific, or educational purposes.
None known.

C. Disease or predation.
None known.

D. The inadequacy of existing regulatory mechanisms.

Pigs are managed in Hawaii as game animals but may populate inaccessible areas where hunting is difficult, if not impossible, and therefore has little effect on their numbers (Hawaii Heritage Program 1990). Pig hunting is allowed on all islands either year-round or during certain months, depending on the area (Hawaii Department of Land and Natural Resources n.d.-a, n.d.-b, n.d.-c). However, public hunting does not adequately control the number of pigs to eliminate this threat to *Cyrtandra oxybapha*. Pig exclusion fences protect the smaller of the two known populations of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

E. Other natural or manmade factors affecting its continued existence.

This species is threatened by alien plant species (R. Hobdy, pers. comm. 1996; A. Medeiros III, pers. comm. 1996; S. Perlman, pers. comm. 1996).

The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent were introduced from other parts of the world, and nearly 100 species have become pests (Smith 1985; Wagner *et al.* 1999a). Several studies (Cuddihy and Stone 1990; Wood and Perlman 1997; Robichaux *et al.* 1998) indicate nonnative plant species may outcompete native plants similar to *Cyrtandra oxybapha*. Competition may be for space, light, water, or nutrients, or there may be a chemical inhibition of other plants (Smith 1985; Cuddihy and Stone 1990). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smathers and Gardner 1978; Smith 1985; Loope and Medeiros 1992; Medeiros *et al.* 1992; Ellshoff *et al.* 1995; Meyer and Florence 1996; Medeiros *et al.* 1997; Loope *et al.* 2004). In particular, alien pest plant species modify habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985; Cuddihy and Stone 1990; Vitousek *et al.* 1987). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to habitat of *Cyrtandra oxybapha*, the Service believes nonnative plant species are a threat to *Cyrtandra oxybapha*. The remaining unmanaged populations of *Cyrtandra oxybapha* are still impacted by this threat.

Nonnative plants are being controlled in the smaller of the two known populations of this species, but will probably never be completely eradicated because new propagules are constantly being dispersed into the fenced area from surrounding, unmanaged lands. Many widespread alien taxa cannot be completely eradicated from an island or the State, and therefore are expected to disperse into previously managed areas (Loope 1998, Smith 1985). The remaining population of the species is still impacted by this threat.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

The Service has funded several projects on Maui that provide conservation benefits to *Cyrtandra oxybapha*. In west Maui, the West Maui Watershed Partnership, a non-governmental, non-profit partnership composed of west Maui landowners and managers will construct ungulate exclosure fences, and control ungulates and nonnative plants within the exclosures in the west Maui Mountains (Maui Pineapple Company, Ltd. 1999). In August 2004, the State Division of Forestry and Wildlife began construction of an ungulate exclosure fence in the Kahakuloa Game

Management Area. In east Maui, a non-profit grassroots community organization on Maui plans to construct ungulate exclosure fences and outplant individuals of *C. oxybapha*, in the Kahikinui Forest Reserve area, in the near future. The Leeward Haleakala Watershed Restoration Partnership has received funding this year from the Service to develop a management plan and begin fencing and feral ungulate and weed control.

SUMMARY OF THREATS:

The major threats to this taxon are pigs and nonnative plant species, which are believed to be a major cause of the decline of this species throughout its range. Feral pigs have been fenced out of the smaller of the two populations of *Cyrtandra oxybapha*, but the fences must be continually maintained to prevent incursion. Nonnative plants have been reduced in the fenced population. These on-going conservation efforts for this species benefit only the smaller of the two known populations. The species as a whole is still impacted by these threats and will require long-term monitoring and management to maintain threat free areas.

LISTING PRIORITY:

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2*
	Non-imminent	Subspecies/population	3
		Monotypic genus	4
		Species	5
Moderate to Low	Imminent	Subspecies/population	6
		Monotypic genus	7
		Species	8
	Non-imminent	Subspecies/population	9
		Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude:

This species is highly threatened by pigs that degrade and destroy habitat, and by nonnative plants that outcompete and displace it. Threats to wet forest habitat of *Cyrtandra oxybapha* and to individuals of this species occur throughout its range, and are expected to continue or increase without their control or eradication. Feral pigs have been fenced out of the smaller of the two populations of *Cyrtandra oxybapha*, but the fences must be continually maintained to prevent incursion. Nonnative plants have been reduced in the fenced population. These on-going conservation efforts for this species benefit only the smaller of the two known populations. The species as a whole is still impacted by these threats and will require long-term monitoring and management to maintain threat free areas.

Imminence:

Threats to *Cyrtandra oxybapha* from pigs and nonnative plants are considered imminent because they are ongoing. However, the Service has funded several projects on Maui that will provide future conservation benefits to *Cyrtandra oxybapha*. When these management actions are implemented the LPN for this species will be reevaluated. In west Maui, the West Maui Watershed Partnership will construct ungulate exclosure fences, and control ungulates and nonnative plants within the exclosures in the west Maui mountains. In August 2004, the State Division of Forestry and Wildlife began construction of an ungulate exclosure fence in the Kahakuloa Game Management Area. In east Maui, a non-profit grassroots community organization on Maui plans to construct ungulate exclosure fences and outplant individuals of *C. oxybapha*, in the Kahikinui Forest Reserve area, in the near future. The Leeward Haleakala Watershed Restoration Partnership has received funding this year from the Service to develop a management plan and begin fencing and feral ungulate and weed control.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the species' total populations within the time frame of the routine listing process. In addition, the Service has funded several conservation actions that will benefit *Cyrtandra oxybapha*, including ungulate exclosures in the west Maui mountains, an exclosure in the Kahakuloa Game Management Area, and ungulate exclosures and outplanting of *C. oxybapha* in the Kahikinui Forest Reserve, Leeward Haleakala Watershed Restoration Partnership will begin fencing and weed control this year. If it becomes apparent that the routine listing process is not sufficient to prevent large losses that may result in this species' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *C. oxybapha* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

DESCRIPTION OF MONITORING:

Much of the information in this form is based on the results of a meeting of 20 botanical experts held by the Center for Plant Conservation in December of 1995, and was updated by personal communication with Robert Hobdy of the Hawaii Division of Forestry and Wildlife in 1996, Arthur C. Medeiros III of the U.S.G.S. Biological Resources Discipline in 1996, and Steve Perlman of National Tropical Botanical Garden in 1996. We have incorporated additional information on this species from our files and the most recent supplement to the *Manual of the Flowering Plants of Hawaii* (Wagner and Herbst 2003). In 2004, the Pacific Islands office contacted the following species experts: Bob Hobdy, retired from Hawaii Division of Forestry and Wildlife; Joel Lau, Hawaii Natural Heritage Program; Art Medeiros, U.S.G.S. Biological Resources Discipline; Hank Oppenheimer, resource manager for Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. New information was provided by Hank Oppenheimer in 2004. In 2005 we contacted the species

experts listed below, but received no new information on this taxon.

The Hawaii Natural Heritage Program identified this species as critically imperiled (Hawaii Natural Heritage Program Database 2004). Based on the International Union for Conservation of Nature and Natural Resources Red Plant Data Book rarity categories, this species is recognized as Rare (could be considered at risk) by Wagner *et al.* (1999b).

Species experts were contacted but did not provide new information this year, no new literature was found, and no known entities are studying this species. However, it is highly likely that the previously reported threats continue to impact the species at the same or an increased level.

COORDINATION WITH STATES:

In October 2004 we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. Vickie Caraway, the State botanist, reviewed the information for this species and provided no additional information or corrections (V. Caraway, pers. comm. 2005).

LITERATURE CITED

List all experts contacted:

Name	Date	Place of Employment
1. Joel Lau	June 28, 2005	Hawaii Natural Heritage Program
2. Art Medeiros	June 28, 2005	U.S.G.S. Biological Resources Discipline
3. Jim Jacobi	June 28, 2005	U.S.G.S. Biological Resources Discipline
4. Rick Warshauer	June 28, 2005	U.S.G.S. Biological Resources Discipline
5. Hank Oppenheimer	June 28, 2005	Maui Land and Pineapple Company
6. Kapua Kawelo	June 28, 2005	U.S. Army
7. Dave Lorence	June 28, 2005	National Tropical Botanical Garden
8. Steve Perlman	March 29, 2005	National Tropical Botanical Garden
9. Ken Wood	August 2, 2005	National Tropical Botanical Garden
10. Marie Brueggmann	July 13, 2005	U.S. Fish and Wildlife Service
11. Vickie Caraway	June 14, 2005	Hawaii Division of Forestry and Wildlife

List all databases searched:

Name	Date
1. Hawaii Natural Heritage Program	2004

Other resources utilized:

Center for Biological Diversity, Dr. Jane Goodall, Dr. E.O. Wilson, Dr. Paul Ehrlich, Dr. John Terborgh, Dr. Niles Eldridge, Dr. Thomas Eisner, Dr. Robert Hass, Barbara Kingsolver, Charles Bowden, Martin Sheen, the Xerces Society, and the Biodiversity Conservation Alliance. 2004. Hawaiian Plants: petitions to list as federally endangered species. May 4, 2004.

Cuddihy, L.W., and C.P. Stone. 1990. Alteration of native Hawaiian vegetation; effects of humans, their activities and introductions. Coop. Natl. Park Resources Stud. Unit, Hawaii. 138 pp.

- Ellshoff, Z.E., D.E. Gardner, C. Wikler, and C.W. Smith. 1995. Annotated bibliography of the genus *Psidium*, with emphasis on *P. cattleianum* (strawberry guava) and *P. guajava* (common guava), forest weeds in Hawai'i. Cooperative National Park Resources Studies Unit, University of Hawaii. Technical Report 95.
- Hawaii, Department of Land and Natural Resources. N.d.-a. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Oahu. Division of Forestry and Wildlife, Honolulu. 2 pp.
- Hawaii, Department of Land and Natural Resources. N.d.-b. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Molokai. Division of Forestry and Wildlife, Honolulu. 2 pp.
- Hawaii, Department of Land and Natural Resources. N.d.-c. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Maui. Division of Forestry and Wildlife, Honolulu. 2 pp.
- Loope, L.L. and A.C. Medeiros. 1992. A new and invasive grass on Maui. Newsletter of the Hawaiian Botanical Society 31: 7-8.
- Loope, L.L. 1998. Hawaii and Pacific Islands. Pp. 747-774. In: M.J. Mac, P.A. Opler, C.E. Puckett Haecker, and P.D. Doran (eds.). Status and Trends of the Nation's Biological Resources, Volume 2. U.S. Department of the Interior, U.S. Geological Survey, Reston, VA.
- Loope, L., F. Starr and K. Starr. 2004. Management and research for protecting endangered Hawaiian plant species from displacement by invasive plants on Maui, Hawaii. Weed Technology 18: 1472-1474.
- Maui Pineapple Company, Ltd. 1999. Pu'u Kukui Watershed Management Area, Kahalawai, Maui, Hawai'i, Fiscal Year 1999 Progress Report, Biannual Report. Submitted to the State of Hawai'i Department of Land and Natural Resources Natural Area Partnership Program, January, 1999.
- Medeiros, A.C., L.L. Loope, P. Conant and S. McElvaney. 1997. Status, ecology, and management of the invasive plant, *Miconia calvenscens* DC (Melastomataceae) in the Hawaiian Islands. Bishop Mus. Occas. Pap.48: 23-36.
- Medeiros, A.C., L.L. Loope, T. Flynn, S.J. Anderson, L.W. Cuddihy, and K.A. Wilson. 1992. Notes on the status of an invasive Australian tree fern (*Cyathea cooperi*) in Hawaiian rain forests. American Fern Journal 82: 27-33.
- Medeiros, A.C., Jr., L.L. Loope, and R.A. Holt. 1986. Status of native flowering plant species on the south slope of Haleakala, East Maui, Hawaii. Coop. Natl. Park Resources Stud. Unit, Hawaii, Techn. Rept. 59:1-230.
- Meyer, J.-Y. and J. Florence. 1996. Tahiti's native flora endangered by the invasion of *Miconia calvenscens* D.C. (Melastomataceae). Journal of Biogeography 23: 775-781.
- Robichaux, R., J. Canfield, F. R. Warshauer, L. Perry, M. Brueggmann, and G. Carr. 1998. Adaptive Radiation. Endangered Species Bulletin. November/December.
- Scott, J.M., S. Mountainspring, F.L. Ramsey, and C.B. Kepler. 1986. Forest bird communities of the Hawaiian Islands: Their dynamics, ecology, and conservation. Studies in Avian Biology 9: 1-429. Cooper Ornithological Society, Los Angeles.
- Smathers, G.A. and D.E. Gardner. 1978. Stand analysis of an invading firetree (*Myrica faya* Aiton) population, Hawai'i. Proceeding of the Second Conference on Natural Science, Hawaii Volcanoes National Park, pp. 274-288.

- Smith, C.W. 1985. Impact of alien plants on Hawai'i's native biota: *in* Stone, C.P., and J.M. Scott (eds.), Hawai'i's Terrestrial Ecosystems: Preservation and Management. Coop. Natl. Park Resources Stud. Unit, Univ. Hawaii, Honolulu, pp. 180-250.
- Stone, C.P. 1985. Alien animals in Hawai'i's native ecosystems: toward controlling the adverse effects of introduced vertebrates: *in* Stone, C.P., and J.M. Scott (eds.), Hawai'i's Terrestrial Ecosystems: Preservation and Management. Coop. Natl. Park Resources Stud. Unit, Univ. Hawaii, Honolulu, pp. 251-297.
- Tomich, P.Q. 1986. Mammals in Hawai'i: A synopsis and notational bibliography. Bishop Museum Press, Honolulu. 375 pp.
- Vitousek, P.M., C.M. D'Antonio, L.L. Loope, M. Rejnaneck, and R. Westerbrooks. 1997. Introduced species: a significant component of human-caused global change. *New Zealand Journal of Ecology* 21(1): 1-16.
- Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1999a. Manual of the Flowering Plants of Hawai'i, Bishop Mus. Spec. Publ. 97: 1-1918. University of Hawaii Press and Bishop Museum Press, Honolulu.
- Wagner, W.L., M.M. Brueggemann, and J.Q.C. Lau. 1999b. Hawaiian vascular plants at risk: 1999. Bishop Mus. Occas. Pap. 60: 1-58.
- Wagner, W.L. and D.R. Herbst. 2003. Electronic supplement to the manual of flowering plants of Hawai'i, version 3.1. December 12, 2003. Available from the Internet. URL: <http://rathbun.si.edu/botany/pacificislandbiodiversity/hawaiianflora/supplement.htm>.
- Wenkam, R. 1969. Kauai and the park country of Hawaii. Sierra Club, San Francisco. 160 pp.
- Wood, K.R. and S. Perlman. 1997. Maui 14 plant survey final report. Submitted by National Tropical Botanical Garden, October, 1997.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all 12-month petition findings, additions of species to the candidate list, removal of candidate species, and listing priority changes.

Approve: **Acting** David W. Winkler 11/10/05
Regional Director, Fish and Wildlife Service Date

Marshall P. Jones

Concur: _____ August 23, 2006
Director, Fish and Wildlife Service Date

Do not concur: _____
Director, Fish and Wildlife Service Date

Date of annual review: September 20, 2005
Conducted by: Marie M. Brueggmann, Pacific Islands FWO
Plant Recovery Coordinator

Comments:
PIFWO Review

Reviewed by: Christa Russell Date: September 21, 2005
Plant Conservation Program Leader

Gina Shultz Date: October 13, 2005
Assistant Field Supervisor,
Endangered Species

Patrick Leonard Date: October 14, 2005
Field Supervisor